

## CLAIMS

What is claimed is:

- 1           1. A fiber optic module for coupling photons between  
2     optoelectronic devices and optical fibers, the fiber optic  
3     module comprising:  
4           a base;  
5           a first horizontal printed circuit board (PCB) arranged  
6     horizontally with the base and parallel to a first optical  
7     axis of a first optoelectronic device, the first  
8     optoelectronic device having terminals coupled to the first  
9     horizontal printed circuit board; and  
10          a second vertical printed circuit board (PCB) arranged at  
11     a perpendicular angle with the base and parallel to a second  
12     optical axis of a second optoelectronic device, the second  
13     optoelectronic device having terminals coupled to the second  
14     vertical printed circuit board.
- 1           2. The fiber optic module of claim 1 further comprising:  
2           a housing coupled to the base.
- 1           3. The fiber optic module of claim 2 wherein,  
2           the housing is a shielded housing to encase the first and  
3           second printed circuit boards to reduce electromagnetic  
4           interference (EMI).
- 1           4. The fiber optic module of claim 3 wherein,  
2           the housing has an inner septum to separate the fiber  
3           optic module into a first side and a second side and the inner  
4           septum is a conductive shield to reduce crosstalk  
5           electromagnetic radiation.

1        5. The fiber optic module of claim 1 wherein,  
2        the base has a first and second opening;  
3        the first horizontal printed circuit board has a  
4        plurality of pins extending through the first opening in the  
5        base to couple to a host printed circuit board; and  
6        the second vertical printed circuit board has a plurality  
7        of pins extending through the second opening in the base to  
8        couple to the host printed circuit board.

1           6. The fiber optic module of claim 5 wherein,  
2           the first and second opening in the base are a plurality  
3           of pin holes in the base.

1           7. The fiber optic module of claim 5 wherein,  
2           the first and second opening in the base are a first and  
3           second cutout in the base.

1        8. The fiber optic module of claim 1 wherein, the first  
2 horizontal and second vertical printed circuit boards further  
3 comprises:  
4        electrical components coupled between the first  
5 optoelectronic device and the plurality of pins of the first  
6 printed circuit board and between the second optoelectronic  
7 device and the plurality of pins of the second printed circuit  
8 board, the electrical components for controlling the first and  
9 second optoelectronic devices.

1           9. The fiber optic module of claim 1 wherein, the first  
2 horizontal printed circuit board further comprises:  
3           a ground plane to reduce electro-magnetic fields  
4 generated by the electrical components.

1        10. The fiber optic module of claim 1 wherein, the second  
2 vertical printed circuit board further comprises:

3        a ground plane to reduce electro-magnetic fields  
4 generated by the electrical components.

1        11. The fiber optic module of claim 1 further comprising:  
2        a first optical block coupled to the first optoelectronic  
3 device, the first optical block having a first opening to  
4 receive the first optoelectronic device, and

5        a first lens to couple photons between the first  
6 optoelectronic device and an optical fiber.

1        12. The fiber optic module of claim 11 further  
2 comprising:

3        a nose coupled to the base, the nose to receive an  
4 optical fiber connector and to hold an optical fiber  
5 substantially fixed and aligned with an optical opening of the  
6 optical block.

1        13. The fiber optic module of claim 12 further  
2 comprising:

3        a nose shield surrounding the nose to reduce  
4 electromagnetic interference.

1        14. The fiber optic module of claim 1 further comprising:

2        a second optical block coupled to the second  
3 optoelectronic device, the second optical block having  
4        a second opening to receive the second optoelectronic  
5 device, and

6        a second lens to couple photons between the second  
7 optoelectronic device and an optical fiber.

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1        15. The fiber optic module of claim 11 further  
2 comprising:

3        a second optical block coupled to the second  
4 optoelectronic device, the second optical block having  
5        a second opening to receive the second optoelectronic  
6 device, and

7        a second lens to couple photons between the second  
8 optoelectronic device and an optical fiber.

1        16. The fiber optic module of claim 1 further comprising:

2        an optical block coupled to the first and second

3 optoelectronic devices, the optical block having

4        first and second openings to receive the first and second  
5 optoelectronic devices,

6        a first lens to couple photons between the first  
7 optoelectronic device and a first optical fiber, and

8        a second lens to couple photons between the second  
9 optoelectronic device and a second optical fiber.

1        17. The fiber optic module of claim 16, wherein,

2        the first lens of the optical block to launch photons  
3 into the first optical fiber from the first optoelectronic  
4 device.

1        18. The fiber optic module of claim 16, wherein,

2        the second lens of the optical block is a focusing lens  
3 to receive photons from the second optical fiber and to couple  
4 them to the second optoelectronic device.

1        19. The fiber optic module of claim 16 further

2 comprising:

3 a nose coupled to the base, the nose to receive an  
4 optical fiber connector and to hold an optical fiber  
5 substantially fixed and aligned with an optical opening of the  
6 optical block.

1 20. The fiber optic module of claim 19 further  
2 comprising:

3 a nose shield surrounding the nose to reduce  
4 electromagnetic interference.

1 21. The fiber optic module of claim 13, wherein,  
2 the first optoelectronic device is a photodetector.

1 22. The fiber optic module of claim 13, wherein,  
2 the second optoelectronic device is an emitter.

1 23. The fiber optic module of claim 22, wherein,  
2 the emitter is a vertical cavity surface emitting laser  
3 (VCSEL).

1 24. A fiber optic transceiver for coupling photons  
2 between optoelectronic devices and optical fibers, the fiber  
3 optic transceiver comprising:

4 a base;

5 a first vertical printed circuit board (PCB) arranged at  
6 a perpendicular angle with the base and parallel to a first  
7 optical axis of a first optoelectronic device, the first  
8 vertical printed circuit board having a first connecting means  
9 to couple to an external printed circuit board, the first  
10 optoelectronic device having terminals coupled to the first  
11 vertical printed circuit board;

12 a second slanted printed circuit board (PCB) arranged at

13 an angle with the base and parallel to a second optical axis  
14 of a second optoelectronic device, the second slanted printed  
15 circuit board having a second connecting means to couple to an  
16 external printed circuit board, the second optoelectronic  
17 device having terminals coupled to the second slanted printed  
18 circuit board;

19 a housing coupled to the base, the housing to cover the  
20 first vertical printed circuit board and the second slanted  
21 printed circuit board.

1 25. The fiber optic transceiver of claim 24 wherein,  
2 the first vertical printed circuit board further  
3 comprises:

4 first electrical components coupled between the  
5 first optoelectronic device and the first connecting  
6 means on a first side of the first internal printed  
7 circuit board, the first electrical components for  
8 controlling the first optoelectronic device, and

9 a first ground plane coupled to a second side of the  
10 first internal printed circuit board to reduce electro-  
11 magnetic fields;

12 and,

13 the second slanted printed circuit board further  
14 comprises:

15 second electrical components coupled between the second  
16 optoelectronic device and the second connecting means on a  
17 first side of the second slanted printed circuit board, the  
18 second electrical components for controlling the second  
19 optoelectronic device.

1 26. The fiber optic transceiver of claim 25 wherein,  
2 the second slanted printed circuit board further  
3 comprises:

4 a second ground plane coupled to a second side of  
5 the second slanted printed circuit board to reduce  
6 electro-magnetic fields.

1 27. The fiber optic transceiver of claim 24, wherein,  
2 the first connecting means and the second connecting  
3 means are pins to couple to pin receptacles of the external  
4 printed circuit board.

1 28. The fiber optic transceiver of claim 24, wherein,  
2 the first connecting means and the second connecting  
3 means are connectors to couple into connectors of the external  
4 printed circuit board.

1 29. The fiber optic transceiver of claim 24 further  
2 comprising:  
3 an optical block coupled to the first optoelectronic  
4 device and the second optoelectronic device, the optical block  
5 having a first lens to couple photons between the first  
6 optoelectronic device and a first optical fiber and a second  
7 lens to couple photons between the second optoelectronic  
8 device and a second optical fiber.

1 30. The fiber optic transceiver of claim 24 further  
2 comprising:  
3 a first optical block coupled to the first optoelectronic  
4 device, the first optical block having a first lens to couple  
5 photons between the first optoelectronic device and a first  
6 optical fiber, and  
7 a second optical block coupled to the second  
8 optoelectronic device, the second optical block having a  
9 second lens to couple photons between the second

10 optoelectronic device and a second optical fiber.

1 31. The fiber optic transceiver of claim 24 further  
2 comprising:

3 a nose coupled to the base, the nose for receiving an  
4 optical fiber connector and holding a pair of optical fibers  
5 substantially fixed and aligned with the first optoelectronic  
6 device and the second optoelectronic device.

1 32. The fiber optic transceiver of claim 31 further  
2 comprising:

3 a nose shield surrounding the nose to reduce  
4 electromagnetic interference.

1 33. The fiber optic transceiver of claim 24 further  
2 comprising:

3 an internal shield inserted between the first vertical  
4 printed circuit board and the second slanted printed circuit  
5 board, the internal shield to reduce electrical crosstalk.

1 34. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic  
3 module comprising:

4 a base;

5 a first slanted printed circuit board (PCB) arranged on a  
6 slanted angle with the base and parallel to a first optical  
7 axis of a first optoelectronic device, the first slanted  
8 printed circuit board having a ground plane on one side, the  
9 first optoelectronic device having terminals coupled to the  
10 first slanted printed circuit board;

11 a second vertical printed circuit board (PCB) arranged at  
12 a perpendicular angle with the base and parallel to a second



13 optical axis of a second optoelectronic device, the second  
14 optoelectronic device having terminals coupled to the second  
15 vertical printed circuit board; and  
16 a housing coupled to the base.

1 35. The fiber optic module of claim 34 wherein,  
2 the housing is a shielded housing to encase the first  
3 slanted and second vertical printed circuit boards to reduce  
4 electromagnetic interference (EMI).

1 36. The fiber optic module of claim 34 wherein,  
2 the second vertical printed circuit board has a ground  
3 plane on one side.

1 37. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic  
3 module comprising:  
4 a base;  
5 a first slanted printed circuit board (PCB) arranged on a  
6 slanted angle with the base and parallel to a first optical  
7 axis of a first optoelectronic device, the first  
8 optoelectronic device having terminals coupled to the first  
9 slanted printed circuit board; and  
10 a second slanted printed circuit board (PCB) arranged on  
11 a slanted angle with the base and parallel to a second optical  
12 axis of a second optoelectronic device, the second slanted  
13 printed circuit board having a ground plane on one side, the  
14 second optoelectronic device having terminals coupled to the  
15 second vertical printed circuit board; and  
16 a housing coupled to the base.

1 38. The fiber optic module of claim 37 wherein,

2 the housing is a shielded housing to encase the first and  
3 second printed circuit boards to reduce electromagnetic  
4 interference (EMI).

1 39. The fiber optic module of claim 37 wherein,  
2 the first slanted printed circuit board has a ground  
3 plane on one side.

1 40. A fiber optic module comprising:  
2 a first optical block having a first opening to receive a  
3 first optoelectronic device;  
4 the first optoelectronic device coupled into the first  
5 opening;  
6 a second optical block having a second opening to receive  
7 a second optoelectronic device;  
8 the second optoelectronic device coupled into the second  
9 opening;  
10 a first printed circuit board coupled to terminals of the  
11 first optoelectronic device in parallel with a plane of the  
12 first optical block, the first printed circuit board parallel  
13 to a first optical axis of the first optoelectronic device;  
14 and  
15 a second printed circuit board coupled to terminals of  
16 the second optoelectronic device perpendicular with a plane of  
17 the second optical block, the second printed circuit board  
18 parallel to a second optical axis of the second optoelectronic  
19 device.

1 41. The fiber optic module of claim 40, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a transmitter to  
4 couple photons into a first optical fiber, and  
5 the second optoelectronic device is a receiver to receive

6 photons from a second optical fiber.

1 42. The fiber optic module of claim 40, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a receiver to receive  
4 photons from a first optical fiber, and  
5 the second optoelectronic device is a transmitter to  
6 couple photons into a second optical fiber.

1 43. A fiber optic module comprising:  
2 an optical block having a first opening to receive a  
3 first optoelectronic device and a second opening to receive a  
4 second optoelectronic device;  
5 the first optoelectronic device coupled into the first  
6 opening;  
7 the second optoelectronic device coupled into the second  
8 opening;  
9 a base having a first guide rail;  
10 a first vertical printed circuit board coupled to  
11 terminals of the first optoelectronic device in parallel to a  
12 first optical axis of the first optoelectronic device, the  
13 first vertical printed circuit board coupled to the first  
14 guide rail of the base perpendicular with the base; and  
15 a second horizontal printed circuit board coupled to  
16 terminals of the second optoelectronic device in parallel to a  
17 second optical axis of the second optoelectronic device, the  
18 second horizontal printed circuit board parallel to the base.

1 44. The fiber optic module of claim 43 further  
2 comprising:  
3 a housing coupled to the base.

1 45. The fiber optic module of claim 44 wherein,  
2 the housing is a shielded housing to encase the first  
3 vertical and second horizontal printed circuit boards to  
4 reduce electromagnetic interference (EMI).

1 46. The fiber optic module of claim 43 wherein,  
2 the base has a pair of cutouts to allow pins of the first  
3 vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 47. The fiber optic module of claim 43 wherein,  
2 the base has a pair of openings to allow pins of the  
3 first vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 48. The fiber optic module of claim 43, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a transmitter to  
4 couple photons into a first optical fiber, and  
5 the second optoelectronic device is a receiver to receive  
6 photons from a second optical fiber.

1 49. The fiber optic module of claim 43, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a receiver to receive  
4 photons from a first optical fiber, and  
5 the second optoelectronic device is a transmitter to  
6 couple photons into a second optical fiber.

1 50. A fiber optic module comprising:  
2 an optical block having a first opening to receive a

3 first optoelectronic device and a second opening to receive a  
4 second optoelectronic device;  
5 the first optoelectronic device coupled into the first  
6 opening;  
7 the second optoelectronic device coupled into the second  
8 opening;  
9 a base having a pair of brackets on one side;  
10 a first vertical printed circuit board coupled to  
11 terminals of the first optoelectronic device in parallel to a  
12 first optical axis of the first optoelectronic device, the  
13 first vertical printed circuit board coupled to the pair of  
14 brackets of the base; and  
15 a second horizontal printed circuit board coupled to  
16 terminals of the second optoelectronic device in parallel to a  
17 second optical axis of the second optoelectronic device, the  
18 second horizontal printed circuit board parallel to the base.

1 51. The fiber optic module of claim 50 further  
2 comprising:  
3 a housing coupled to the base.

1 52. The fiber optic module of claim 50 wherein,  
2 the housing is a shielded housing to encase the first  
3 vertical and second horizontal printed circuit boards to  
4 reduce electromagnetic interference (EMI).

1 53. The fiber optic module of claim 50 wherein,  
2 the base has a pair of cutouts to allow pins of the first  
3 vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 54. The fiber optic module of claim 50 wherein,

2 the base has a pair of openings to allow pins of the  
3 first vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 55. The fiber optic module of claim 50, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a transmitter to  
4 couple photons into a first optical fiber, and  
5 the second optoelectronic device is a receiver to receive  
6 photons from a second optical fiber.

1 56. The fiber optic module of claim 50, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a receiver to receive  
4 photons from a first optical fiber, and  
5 the second optoelectronic device is a transmitter to  
6 couple photons into a second optical fiber.

1 57. A fiber optic module comprising:  
2 an optical block having a first opening to receive a  
3 first optoelectronic device and a second opening to receive a  
4 second optoelectronic device, the optical block further having  
5 a first slot to receive an end of a first vertical printed  
6 circuit board and a second slot to receive an end of a second  
7 horizontal printed circuit board;  
8 the first optoelectronic device coupled into the first  
9 opening;  
10 the second optoelectronic device coupled into the second  
11 opening;  
12 a base;  
13 the first vertical printed circuit board coupled to  
14 terminals of the first optoelectronic device in parallel to a  
15 first optical axis of the first optoelectronic device, the

16 first vertical printed circuit board coupled to the first slot  
17 of the optical block perpendicular with the base; and  
18 the second horizontal printed circuit board coupled to  
19 terminals of the second optoelectronic device in parallel to a  
20 second optical axis of the second optoelectronic device, the  
21 second horizontal printed circuit board coupled to the second  
22 slot of the optical block in parallel with the base.

1 58. The fiber optic module of claim 57 further  
2 comprising:  
3 a housing coupled to the base.

1 59. The fiber optic module of claim 58 wherein,  
2 the housing is a shielded housing to encase the first  
3 vertical and second horizontal printed circuit boards to  
4 reduce electromagnetic interference (EMI).

1 60. The fiber optic module of claim 57 wherein,  
2 the base has a pair of cutouts to allow pins of the first  
3 vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 61. The fiber optic module of claim 57 wherein,  
2 the base has a pair of openings to allow pins of the  
3 first vertical printed circuit board and pins of the second  
4 horizontal printed circuit board to extend through.

1 62. The fiber optic module of claim 57, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3 the first optoelectronic device is a transmitter to  
4 couple photons into a first optical fiber, and  
5 the second optoelectronic device is a receiver to receive

6 photons from a second optical fiber.

1        63. The fiber optic module of claim 57, wherein the fiber  
2 optic module is a fiber optic transceiver and  
3        the first optoelectronic device is a receiver to receive  
4 photons from a first optical fiber, and  
5        the second optoelectronic device is a transmitter to  
6 couple photons into a second optical fiber.

1        64. A fiber optic module comprising:  
2        an optical block having a first opening to receive a  
3 first optoelectronic device and a second opening to receive a  
4 second optoelectronic device;  
5        the first optoelectronic device coupled into the first  
6 opening;  
7        the second optoelectronic device coupled into the second  
8 opening;  
9        a base;  
10       a slanted printed circuit board (PCB) coupled to  
11 terminals of the first optoelectronic device in parallel to a  
12 first optical axis of the first optoelectronic device, the  
13 slanted printed circuit board arranged at an angle to slant  
14 inward from the base; and  
15       a vertical printed circuit board (PCB) coupled to  
16 terminals of the second optoelectronic device in parallel to a  
17 second optical axis of the second optoelectronic device, the  
18 vertical printed circuit board arranged at a perpendicular  
19 angle with the base.

1        65. The fiber optic module of claim 64 further  
2 comprising:  
3        a housing coupled to the base.



1        66. The fiber optic module of claim 65 wherein,  
2        the housing is a shielded housing to encase the first  
3        slanted and second vertical printed circuit boards to reduce  
4        electromagnetic interference (EMI).

1        67. The fiber optic module of claim 65 wherein,  
2        the slanted printed circuit board and the vertical  
3        printed circuit board each have a plurality of pins to couple  
4        to a host system printed circuit board.

1        68. The fiber optic module of claim 67 wherein,  
2        the base has a pair of cutouts to allow the pins of the  
3        slanted printed circuit board and the pins of the vertical  
4        printed circuit board to extend through.

1        69. The fiber optic module of claim 67 wherein,  
2        the base has a pair of openings to allow the pins of the  
3        slanted printed circuit board and the pins of the vertical  
4        printed circuit board to extend through.

1        70. The fiber optic module of claim 64, wherein the fiber  
2        optic module is a fiber optic transceiver and  
3        the first optoelectronic device is a transmitter to  
4        couple photons into a first optical fiber, and  
5        the second optoelectronic device is a receiver to receive  
6        photons from a second optical fiber.

1        71. The fiber optic module of claim 64 wherein,  
2        the slanted printed circuit board and the vertical  
3        printed circuit board each have a connector to couple to a  
4        connector of a host system printed circuit board.

1        72. The fiber optic module of claim 64 further  
2 comprising:  
3        a housing having an opening at an end coupled to the  
4 base.

1        73. The fiber optic module of claim 72, wherein,  
2        the slanted printed circuit board and the vertical  
3 printed circuit board each have a connector to couple to a  
4 connector of a host system printed circuit board through the  
5 opening at the end of the housing.

1        74. The fiber optic module of claim 64 wherein,  
2        the base includes an inner septum to separate the fiber  
3 optic module into a first side and a second side.

1        75. A fiber optic module comprising:  
2        an optical block having a first opening to receive a  
3 first optoelectronic device and a second opening to receive a  
4 second optoelectronic device;  
5        the first optoelectronic device coupled into the first  
6 opening;  
7        the second optoelectronic device coupled into the second  
8 opening;  
9        a base;  
10       a slanted printed circuit board (PCB) coupled to  
11 terminals of the first optoelectronic device in parallel to a  
12 first optical axis of the first optoelectronic device, the  
13 slanted printed circuit board arranged at an angle to slant  
14 outward from the base; and  
15       a vertical printed circuit board (PCB) coupled to  
16 terminals of the second optoelectronic device in parallel to a

17 second optical axis of the second optoelectronic device, the  
18 vertical printed circuit board arranged perpendicular to the  
19 base.

1 76. The fiber optic module of claim 75 further  
2 comprising:  
3 a housing coupled to the base.

1 77. The fiber optic module of claim 76 wherein,  
2 the housing is a shielded housing to encase the slanted  
3 and vertical printed circuit boards to reduce electromagnetic  
4 interference (EMI).

1 78. The fiber optic module of claim 75 wherein,  
2 the slanted printed circuit board and the vertical  
3 printed circuit board each have a pin header with a plurality  
4 of pins to couple to a host system printed circuit board.

1 79. The fiber optic module of claim 75 wherein,  
2 the slanted printed circuit board and the vertical  
3 printed circuit board each have a plurality of pins to couple  
4 to a host system printed circuit board.

1 80. The fiber optic module of claim 79 wherein,  
2 the base has a pair of cutouts to allow the pins of the  
3 slanted printed circuit board and the pins of the vertical  
4 printed circuit board to extend through.

1 81. The fiber optic module of claim 79 wherein,  
2 the base has a pair of openings to allow the pins of the  
3 slanted printed circuit board and the pins of the vertical  
4 printed circuit board to extend through.

1        82. The fiber optic module of claim 75, wherein the fiber  
2        optic module is a fiber optic transceiver and  
3        the first optoelectronic device is a transmitter to  
4        couple photons into a first optical fiber, and  
5        the second optoelectronic device is a receiver to receive  
6        photons from a second optical fiber.

1        83. The fiber optic module of claim 75 wherein,  
2        the slanted printed circuit board and the vertical  
3        printed circuit board each have a connector to couple to a  
4        connector of a host system printed circuit board.

1        84. The fiber optic module of claim 75 further  
2        comprising:  
3        a housing having an opening at an end coupled to the  
4        base.

1        85. The fiber optic module of claim 84, wherein,  
2        the slanted printed circuit board and the vertical  
3        printed circuit board each have a connector to couple to a  
4        connector of a host system printed circuit board through the  
5        opening at the end of the housing.

1        86. The fiber optic module of claim 75 wherein,  
2        the base includes an inner septum to separate the fiber  
3        optic module into a first side and a second side.

1        87. The fiber optic module of claim 75 further  
2        comprising:  
3        a housing having an inner septum to separate the fiber  
4        optic module into a first side and a second side, the housing

5 coupled to the base.

1 88. The fiber optic module of claim 87 wherein,  
2 the housing is a conductive shielded housing to encase  
3 the slanted and vertical printed circuit boards to reduce  
4 electromagnetic interference (EMI) and the septum is a  
5 conductive shield to reduce crosstalk electromagnetic  
6 radiation.

1 89. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic  
3 module comprising:

4 a horizontal printed circuit board (PCB) arranged  
5 horizontally having a first plurality of pins and a second  
6 plurality of pins to couple to a host printed circuit board;

7 a first vertical printed circuit board (PCB) coupled to  
8 the horizontal printed circuit board arranged at a  
9 perpendicular angle and parallel to a first optical axis of a  
10 first optoelectronic device, the first optoelectronic device  
11 having terminals coupled to the first vertical printed circuit  
12 board.

13 a second vertical printed circuit board (PCB) coupled to  
14 the horizontal printed circuit board arranged at a  
15 perpendicular angle and parallel to a second optical axis of a  
16 second optoelectronic device, the second optoelectronic device  
17 having terminals coupled to the second vertical printed  
18 circuit board; and

19 a housing coupled to the horizontal printed circuit  
20 board.

1 90. The fiber optic module of claim 89 wherein,  
2 the housing is a shielded housing to encase the  
3 horizontal and the first and the second vertical printed

4 circuit boards to reduce electromagnetic interference (EMI).

1 91. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic  
3 module comprising:

4 a base having a first opening and a second opening;

5 a horizontal printed circuit board (PCB) arranged  
6 horizontally having a first plurality of pins protruding  
7 through the first opening and a second plurality of pins  
8 protruding through the second opening to couple to a host  
9 printed circuit board;

10 a first vertical printed circuit board (PCB) coupled to  
11 the horizontal printed circuit board arranged at a  
12 perpendicular angle and parallel to a first optical axis of a  
13 first optoelectronic device, the first optoelectronic device  
14 having terminals coupled to the first vertical printed circuit  
15 board.

16 a second vertical printed circuit board (PCB) coupled to  
17 the horizontal printed circuit board arranged at a  
18 perpendicular angle and parallel to a second optical axis of a  
19 second optoelectronic device, the second optoelectronic device  
20 having terminals coupled to the second vertical printed  
21 circuit board; and

22 a housing coupled to the horizontal printed circuit  
23 board.

1 92. The fiber optic module of claim 91 wherein,  
2 the housing is a shielded housing to encase the  
3 horizontal and the first and the second vertical printed  
4 circuit boards to reduce electromagnetic interference (EMI).

1 93. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic

3 module comprising:

4 a horizontal printed circuit board (PCB) arranged  
5 horizontally having a first plurality of pins and a second  
6 plurality of pins to couple to a host printed circuit board  
7 and a first optoelectronic device having terminals coupled to  
8 the horizontal printed circuit board.

9 a vertical printed circuit board (PCB) coupled to the  
10 horizontal printed circuit board arranged at a perpendicular  
11 angle and parallel to a second optical axis of a second  
12 optoelectronic device, the second optoelectronic device having  
13 terminals coupled to the vertical printed circuit board; and

14 a housing coupled to the horizontal printed circuit  
15 board.

1 94. The fiber optic module of claim 93 wherein,  
2 the housing is a shielded housing to encase the  
3 horizontal and the vertical printed circuit boards to reduce  
4 electromagnetic interference (EMI).

1 95. The fiber optic module of claim 93 wherein,  
2 the horizontal printed circuit board is arranged parallel  
3 to a first optical axis of the first optoelectronic device.

1 96. A fiber optic module for coupling photons between  
2 optoelectronic devices and optical fibers, the fiber optic  
3 module comprising:

4 a base having a first opening and a second opening;

5 a horizontal printed circuit board (PCB) arranged  
6 horizontally having a first plurality of pins protruding  
7 through the first opening and a second plurality of pins  
8 protruding through the second opening to couple to a host  
9 printed circuit board and a first optoelectronic device having  
10 terminals coupled to the horizontal printed circuit board.

11 a vertical printed circuit board (PCB) coupled to the  
12 horizontal printed circuit board arranged at a perpendicular  
13 angle and parallel to a second optical axis of a second  
14 optoelectronic device, the second optoelectronic device having  
15 terminals coupled to the vertical printed circuit board; and  
16 a housing coupled to the base.

1 97. The fiber optic module of claim 96 wherein,  
2 the housing is a shielded housing to encase the  
3 horizontal and the vertical printed circuit boards to reduce  
4 electromagnetic interference (EMI).

1 98. The fiber optic module of claim 96 wherein,  
2 the horizontal printed circuit board is arranged parallel  
3 to a first optical axis of the first optoelectronic device.